# DAIRYING AND DAIRY MANUFACTURING IN ILLINOIS
## AN ECONOMIC ANALYSIS OF THEIR DEVELOPMENT

BY

RALPH JOSEPH MUTTI

B. S., University of Missouri, 1938

M. S. University of Illinois, 1940

## AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN AGRICULTURAL ECONOMICS
IN THE GRADUATE SCHOOL OF THE
UNIVERSITY OF ILLINOIS, 1946

URBANA, ILLINOIS

1947

# DAIRYING AND DAIRY MANUFACTURING IN ILLINOIS
## AN ECONOMIC ANALYSIS OF THEIR DEVELOPMENT

BY

RALPH JOSEPH MUTTI

B. S., University of Missouri, 1938

M. S. University of Illinois, 1940

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN AGRICULTURAL ECONOMICS
IN THE GRADUATE SCHOOL OF THE
UNIVERSITY OF ILLINOIS, 1946

URBANA, ILLINOIS

1947

## ACKNOWLEDGMENTS

The suggestions, criticisms, and assistance contributed by many persons throughout the progress of this study are sincerely appreciated. The author is grateful for the opportunity of securing a significant portion of his material in conjunction with his research for the Illinois Agricultural Experiment Station and for the clerical assistance made available from time to time by the Department of Agricultural Economics.

He is especially indebted to Dr. L. J. Norton, thesis adviser, for assistance in organizing this study and for suggestions throughout its progress, to Dr. R. W. Bartlett for stimulating an interest in the problems of the dairy industry and for critically reading the final draft of the thesis, and to Kathryn Harmon Mutti, his wife, for her assistance in typing and critically reading all copy.

Special acknowledgment is due Mr. A. J. Surratt and colleagues of the Illinois Co-operative Crop Reporting Service, to Mr. B. H. Bennett of the United States Department of Agriculture, to many farm advisers, and to many individuals engaged in the dairy industry of Illinois for the information which they supplied.

# DAIRYING AND DAIRY MANUFACTURING IN ILLINOIS

## AN ECONOMIC ANALYSIS OF THEIR DEVELOPMENT

The primary purpose of this investigation was to find out what changes occurred in dairying and dairy manufacturing within different parts of Illinois between 1849 and 1943. The development in Illinois was also compared to that in selected states and in the geographical divisions of the United States. In a third phase of the investigation an analysis was made of some factors which it was believed affect milk production and the type of dairy manufacturing carried on in different areas.

### Sources of Data Used

This study is mainly a presentation and interpretation of statistical information. Basic data were secured from reports issued by the United States Bureau of the Census, the United States Department of Agriculture, and the *American Butter Review* (and its predecessors); from unpublished data in the files of the United States and Illinois State Departments of Agriculture; and from correspondence and interviews with many persons connected with the state's dairy industry.

### Types of Data Used

From data in census reports for 1850 through 1940, several factors were computed for individual counties, selected states, and geographical divisions for specific years and periods. These factors included gallons of milk produced per acre of land area, number of milk cows per 100 persons, gallons of milk produced per capita, and percentage changes in milk production. The disposition of milk was analyzed from computations of the percentage of milk production sold as whole milk and the pounds of butterfat sold as cream per

100 acres of land area. Comparisons were made of data which were taken direct from census reports on farm and factory production of dairy products.

Annual estimates of milk production and disposition and annual reports on dairy products manufactured in individual states were used. The annual percentage changes in milk production from 1924 through 1944 were computed for geographical regions and for selected states, and the percentage of milk production disposed of at wholesale as whole milk and as cream, at retail as milk and cream and as farm churned butter, and the percentage used on farms was computed for geographical regions. Illinois' share of the national production of each major dairy product and Illinois' rank among the states were computed for each year from 1921 through 1944.

A detailed analysis of changes in dairy product manufacture within Illinois was prepared from unpublished data for the period 1932 through 1943. The number of plants and total production of each dairy product were recorded and percentages of the state total were computed for each crop-reporting district.

In an effort to determine the turnover among dairy manufacturing plants and the type of products made by these plants, a record was prepared of each plant operating in the 1932-1943 period and of the products made each year. Plants were classified into specific groups for purpose of analysis.

The following factors were analyzed in order to observe their relationship to the level of milk production in different areas and to the type of processing carried on: total population and population changes within counties, ratios of changes in the prices of milk and butterfat and the prices of feed and of other farm products, changes in roughage production, and changes in numbers of different classes of livestock. The amount of milk produced, whole milk sales, and cream sales from different size herds was computed for each

county for 1939, as was the change in number of herds of different sizes between 1929 and 1939.

## Milk Production Changes

*Illinois and the nation.* The development of dairying in the United States between 1849 and 1944 was closely related to the population growth of the country and the settlement of new areas. The percentage increase in milk cow numbers in Illinois and the nation was almost identical. Increases in Wisconsin and Michigan and in geographical divisions to the west exceeded those in Illinois, whereas Illinois' increase was above that in regions to the east and south. Illinois had a considerably higher ratio of milk cow numbers to human population than the United States in 1850 but by 1919 its milk production per capita was lower than the national average.

Dairying increased much more in Illinois than in the nation between 1849 and 1889, but between 1889 and 1939 the reverse was true. Over half the national increase in milk production between 1889 and 1939 occurred during the decade, 1919 to 1929. Within the nation, dairy development was greatest in Wisconsin, Minnesota, Iowa and the West South Central, Mountain, and Pacific geographical divisions. Year-to-year percentage changes (increases and decreases) in milk production between 1924 and 1944 averaged largest in the South Central and West North Central regions, and smallest in the South Atlantic and North Atlantic regions; a difference in alternative farming opportunities in these regions was partly accountable.

*Within Illinois.* Specialized milk producing areas had only begun to develop by 1850, and milk cows were distributed throughout the state chiefly according to human population. By 1890 a concentrated milk producing area in northern Illinois had been established. Economic factors which favored this development included a rapidly expanding and nearby market for fluid milk and an excellent railway network,

along with natural factors of temperature, rainfall, topography, and soils.

Milk production in 1919 was no greater than in 1889. Decreases occurred throughout an area just south of the counties bordering on Wisconsin down to an imaginary line running across the state through the southern boundary of Sangamon county. This area is in the heart of the corn belt and had alternative farm income opportunities in selling grain or producing livestock. South of this area increases were the general rule, although some decreases occurred in several counties bordering on the Wabash and Ohio rivers.

The greatest increases in density of production between 1889 and 1939 occurred in counties that had large fluid milk markets and condenseries as outlets. Significant increases occurred between 1919 and 1939 in a broad belt of counties across the central part of the state. Expansion in this area may be attributed to favorable prices for milk in relation to livestock during most of the period, a more complete utilization of feeds produced on the farm, and adoption of labor-saving equipment which made more time available for the dairy enterprise. Decreases or only small increases in production tended to occur in areas where feed unit productivity of farmland was low and few market outlets for fluid milk developed, and where land area was used extensively for nonagricultural purposes.

## Changes in Disposition of Farm Milk Production

*Illinois and the nation.* The manner in which milk was marketed in the period studied was related in a large measure to the population, the amount of milk produced, and the transportation facilities. Not until 1919 did production of butter in factories exceed the quantity churned on farms, and the percentage of milk production sold as milk was no greater in 1924 than in 1899. Illinois reached its peak in production of farm churned butter in 1889 (ten years sooner than the United States) and whole milk marketings increased

from 41 per cent of milk production in 1899 to 45 per cent in 1924.

In every year for which there are records, a greater share of milk production was marketed as whole milk in Illinois than in the United States. Cream sales increased much more than milk production in the nation between 1909 and 1929, the period when large centralizer creameries had their greatest development. The increase was particularly large in the West North Central division. Cream sales in Illinois declined relatively more than in the United States after 1929. Annual data on milk disposition for the period 1924 through 1944 disclose that a greater shift in whole milk marketings took place between 1939 and 1944 than between 1924 and 1939; demand for dairy products made from whole milk was especially high after 1939 because of war requirements.

The greatest shifts in the manner of disposition occurred in the East North Central and Western regions. Whole milk marketings in Illinois during the 1924-1944 period increased relatively more than in the United States; declines in sale of milk and farm churned butter by producers at retail were also greater in Illinois, and similar declines in cream sales and home use of milk occurred in Illinois and the nation.

*Within Illinois.* Counties with large cities were the early leaders in farm butter production, but by 1889 production had become important throughout the state, although it averaged higher in the northern than in the southern half. Only about one-sixth as much butter was churned on Illinois farms in 1939 as in 1889.

Cream sales were important only in the northwestern section of Illinois in 1909, but by 1919 southeastern Illinois ranked highest in density of cream sales. Increases between 1919 and 1929 were greatest in northwestern Illinois and in a belt of counties across the central and north-central part of the state; these same counties experienced the greatest

declines in cream sales betwen 1929 and 1944.

In only a few counties was a high percentage of milk production sold as whole milk in 1919; there were large cities or large condenseries in or adjacent to these counties. In the vast majority of counties *less* than 20 per cent of the 1919 milk production was sold as whole milk, whereas in 1939 *more* than 20 per cent of the production was sold as whole milk in nearly all counties. The least change occurred in southern Illinois, chiefly because of a lower density of milk production and fewer outlets for whole milk.

Increased marketings of whole milk were especially marked after 1934. The establishment of many new plants receiving whole milk (especially cheese plants) and increased output of existing condenseries and fluid milk plants were factors primarily responsible.

## Developments in Dairy Product Manufacture

*Illinois and the nation.* Factory production of dairy products became established during the period covered by this study, so that important changes were observed in the analysis. The manufacture of all major dairy products expanded greatly, each reaching its peak production in 1941, 1942, or 1944. Throughout the period more of the national milk production was utilized in the manufacture of creamery butter than in the combined total of all other dairy products made in factories, but the output of other products after 1921 increased relatively more than that of butter.

Illinois accounted for over 14 per cent of the national output of creamery butter in 1879 and again in 1889, but between 1909 and 1944 Illinois' share ranged between 3.9 and 4.8 per cent. Illinois produced less cheddar cheese in 1919 than in 1879, whereas national output increased. Illinois experienced a tremendous increase in cheese production after 1931, increasing from 1.2 per cent of the national output in 1931 to 7.6 per cent in 1942. Illinois was the leader in the establishment and early development of the evaporated milk

industry, and ranked first in the nation in output of condensed and evaporated milk in 1914. Subsequent development in other areas was slightly greater than in Illinois, and the latter's share, after declining from 8.3 per cent of national output in 1919 to 3.5 per cent in 1925, was at a level slightly above six per cent in most of the years between 1932 and 1944. Illinois produced 8.5 per cent of the national ice cream output in 1921, and 6.1 per cent in 1944; the decrease occurred gradually and was a result of smaller percentage increases in population in Illinois than in the nation.

Among the minor dairy products the reported output of cottage cheese increased more in Illinois than in the nation between 1921 and 1944, whereas dried casein production was at about the same percentage in 1944 after being much greater from 1934 through 1942. Expansion of dry milk production was not as great in Illinois as in the nation, and state output by 1944 was not at as high a level as in 1930 or 1931. Output of condensed buttermilk increased greatly between 1921 and 1929, then declined through 1933; it increased greatly again after 1933, especially in Illinois.

*Within Illinois, 1932-1943.* In this period for which unpublished records were analyzed, the relative importance of the Northeast district in butter production increased; that district became the leader in the state while the West Southwest and East districts' share declined. Output in the East Southeast and in the two southern districts was much lower than in other areas of the state throughout the period. The number of plants (particularly fluid milk plants) making butter increased, but a high percentage of the total output was still made by the large specialized plants (though several shifts in rank among the leading plants occurred).

This period was one of great expansion in the state's cheese industry; the *increase in output between 1939 and 1942 was greater than that in the preceding 70-year period.* In 1932 the old established cheese producing areas in the Northwest district produced two-thirds of the state output; by

1943 that district produced less than half the state production, and manufacture had become established throughout the upper two-thirds of the state. Average output per plant increased along with the great increase in number of plants, as existing plants expanded their facilities and many new plants began operation on a large-scale basis.

The tremendous increase in cheese production was possible because large quantities of milk were available from farms with four to 14 milk cows; many of these farms had been marketing cream, but higher prices for butterfat sold as milk and improved farm-to-market roads which facilitated the pickup of milk at farms encouraged the shift in method of marketing. Market outlets developed because comparatively little capital was required to equip most of the cheese factories established, and the latter in turn were within trucking distance of cheese processing plants.

In contrast to the number of butter and cheese plants, the number of plants producing evaporated milk was no greater in 1943 than in 1932; however, output per plant increased greatly, both in northern and southwestern Illinois (the only producing areas). An increase of 50 per cent occurred in the number of plants making condensed milk; many of these plants were located outside the old established condensery areas and had relatively small outputs.

Ice cream production and plants were heavily concentrated in the Northeast district, though its share of the state output in 1943 was somewhat lower than in 1932. The relative importance of the Central district increased. Despite large increases in plant numbers and total output, the plants averaging the highest output per plant in 1932 were still highest in 1943. Many fluid milk plants and many specialized one-product plants began ice cream production, and many existing plants discontinued the manufacture of other dairy products and began making ice cream or increased its output. The great increase in counter freezers and the ability of leading ice cream manufacturers to retain their leadership indicated

that production of ice cream mix was well adapted to large-scale manufacture.

A few large plants located in the specialized milk producing areas accounted for the major share of powdered milk output in both 1932 and 1943. Increases in 1943 by plants located in general farming areas were particularly noticeable. Cottage cheese production and sherbet production were concentrated in large cities (especially in the Northeast district), and 51 per cent of the condensed buttermilk was made in the Northeast and East districts in 1943.

The two northern districts of the state ranked highest in the manufacture of most dairy products throughout the period; the primary factors responsible were large supplies of milk and ready access to a large market.

### Turnover Among Dairy Manufacturing Plants

This analysis included all plants manufacturing any dairy product (except cottage cheese or sherbet) in Illinois in the period 1932 through 1943. Three hundred fifty-four of the 656 plants analyzed were located in the Northwest and Northeast districts; areas with the lowest density of milk production had the fewest plants.

A net increase of 127 plants in 1943 over 1932 occurred, largely among one-product plants; an increase of 46 occurred in the number of plants making only cheese, of 33 in those making only ice cream, and of nine in those making only condensed milk products; five less one-product plants made butter in 1943 than in 1932. Fluid milk plants making only one product experienced a net increase of 44; 23 of these made ice cream and 18 made butter. The remaining net increases occurred in the number of plants making two or more dairy products, and represented some instances in which one-product plants became more diversified in their operation.

Each plant was classified as continuous, beginning, intermittent, or discontinued—separately for each major product

and collectively for all products.[1] State-wide the total numbers of continuous, beginning, and discontinued plants were almost identical, but within districts the percentage of all plants ranged from 23 per cent in the Southwest to 44 per cent in the West Southwest that were continuous, from 14 per cent in the Southeast to 43 per cent in the East which were beginning, and from 26 per cent in the West to 59 per cent in the Southeast which were discontinued.

Fifty-nine per cent of the plants operating in this period were plants processing just one product, and another 15 per cent were fluid milk plants manufacturing just one product. Those two types accounted for 77 per cent of all plants which discontinued manufacturing, 73 per cent of all plants beginning, and only 55 per cent of all continuous plants.

For the entire state, the number of plants producing each of the major products in this period was as follows: butter, 271; ice cream, 260; cheese, 235; condensed milk, 48; dried milk, 38, and evaporated milk, 15. The highest percentage of continuous plants was among those making evaporated milk, and the lowest percentage among those making cheese. The percentage of beginning plants was highest among those producing cheese, closely followed by those making ice cream. The percentage of plants which discontinued production of a product was highest among those producing butter, followed by plants making cheese and those making dried milk products, and lowest among those making ice cream.

*Differences in types of plants and plant turnover among*

[1]*Continuous* plants included those which manufactured a dairy product every year between 1932 and 1943; *beginning* plants included those which began the manufacture of a product after 1932 and were still active at the end of 1943; *intermittent* plants included those making a product in 1943 and in some other year or years during the 1932-1943 period, but not every consecutive year; *discontinued* plants included those which were active in 1932 or which began operations after 1932 but which were not active at the end of 1943.

*districts.* The *Northwest* district ranked high in the number of plants producing each of the major dairy products and in the percentage of plants operating continuously. Plants making cheese were more numerous than any other type, followed by plants making butter. The percentage of continuous plants was highest among those producing evaporated milk, with those making ice cream second; the percentage of beginning plants was highest among those making condensed and dried milk products; and the percentage of plants which discontinued manufacturing was highest among those producing butter.

In the *Northeast* district plants making ice cream were most numerous, followed by those making butter. The greatest proportion of plants operating continuously was among those making ice cream; about the same percentages for each major product were beginning plants. The percentage discontinuing was greatest among those making dried milk products, those making butter, and those making cheese.

In contrast to other districts, the highest percentage of continuous plants in the *West* district was among those making butter. Half of the plants making dried milk products, and nearly half of those making cheese and of those making ice cream, began such production during the period. About equal numbers of plants reported ice cream, butter, and cheese production.

The *West Southwest* district had more diversified plants and a higher percentage of continuous plants than any other district; the proportion of continuous plants among all types was high. The percentages of both beginning and discontinued plants were highest among those making cheese.

In the *Central* district more plants produced ice cream than any other product. The percentage of beginning plants was highest among those making cheese. In contrast to other districts, the percentage of discontinued plants was hihgest among those making ice cream.

The *East* district had relatively low percentages of plants making any specific product continuously. The highest percentage of beginning plants was among those making cheese. More plants produced butter than any other product.

More plants in the *East Southeast* district discontinued than produced either continuously or began production. The highest percentage of continuous plants was among those making ice cream, while the highest percentage of both beginning and discontinued plants was among those making cheese.

All major dairy products were made in the *Southwest* district. The percentage of continuous plants was highest among those making ice cream. Nearly two-thirds of the plants making ice cream, butter, or dried milk products discontinued their manufacture before 1943.

The *Southeast* district had the fewest plants in the state, the highest percentage of plants which discontinued, and the lowest percentage of beginning plants. The highest percentage of continuous plants was among those making dried milk products, and the highest proportion which discontinued was among those making cheese.

## Economic Factors Related to Dairying and Dairy Manufacturing

*Number of cows milked.* This factor is related to the type of plant that can be profitably operated in a particular area, and may be a factor affecting the quality of milk produced. In 1939 the majority of farms in Illinois with less than ten cows sold cream[1], whereas most of the farms on which ten or more cows were milked sold whole milk.

Over half the milk produced in Illinois in 1939 came from farms milking less than ten cows. In southeastern Illinois over half the milk was produced on farms with less than

[1]Between 1939 and 1944 many of these farms began shipping whole milk.

five cows, whereas in the three northern tiers of counties from 60 to 97 per cent of the total milk output came from farms with ten or more cows. Farms with herds of five to nine cows accounted for over 40 per cent of the total output in southwestern Illinois and in the middle three-fifths of the state.

Between 1929 and 1939, the number of farms on which only one or two cows were milked decreased slightly, the number with three to nine cows declined eight per cent, the number with ten to 19 cows increased nine per cent, and the number with 20 to 29 cows increased 20 per cent. The average size of herd in the state thereby increased. Increased feed production per acre and greater application of mechanical equipment on farms are factors which would help maintain an upward trend in the average size of dairy herd, just as more intense competition of other farm enterprises for farm resources and a relative scarcity of labor might halt or slow down the trend.

*Changes in population.* The dairy development of the nation has been closely related to the growth and shifts in population. The population increases in Illinois furnished an expanding market for milk products, especially fluid milk. Thus some areas possessing fewer natural advantages found it profitable to expand milk production when better market outlets developed.

*Changes in roughage production and milk production.* An analysis of short-time changes in total tame hay production, pasture condition, and corn silage production for the entire state disclosed no direct relationship to milk production, but in the specialized milk producing areas, increases in alfalfa hay production occurred at the same time that increases occurred in milk production. Expansion in acreage of roughage could increase the number of cows that may be kept, but unless additional supplies of grain and feed concentrates are available, lower production per cow may occur.

*Changes in prices of milk and of other farm products.* Many of the year-to-year changes in milk production were associated with changes in the price relationship of milk to feed and to meat animals. Milk production per cow was directly related to the amounts of grains and concentrates fed, and changes in milk production per cow were associated with changes in the milk-feed price ratio. Between 1924 and 1944, *the increase in milk production in Illinois was due more to increases in production per cow than to increases in dairy cow numbers,* but for the nation over two-thirds of the gain in milk production was accounted for by increased cow numbers.

Several periods existed when milk prices were low (or high) relative to livestock prices. The milk-hog price ratio fluctuated more than the milk-beef cattle, milk-veal calf, and milk-chicken price ratios. In periods when the price of milk was high compared to the prices of three or four of these classes of livestock, milk production increased. Beef cattle prices were high relative to milk prices from 1935 through 1944, and beef cattle numbers increased much more than milk cow numbers.

The price ratios varied considerably among districts, but the differences were much less in 1941 than in 1935. The least fluctuation of the milk-hog price ratio occurred in the areas where competition between milk cows and hogs for feed concentrates was most keen. Veal calf prices were highest relative to butterfat prices in southern Illinois. The uneven fluctuations in the various price ratios among districts reflected regional differences in market conditions for farm products.

Milk prices averaged lowest in areas where a high proportion of milk production was utilized in manufactured products. Butterfat prices averaged highest in the northern half of the state, probably because of better quality cream and more alternative markets for milk. Prices of butterfat declined relative to milk prices from 1935 through 1941, a

period in which whole milk marketings increased greatly.

## Conclusions

The comparative advantage of different areas in Illinois for milk production varies greatly, but this inequality is not fixed. Economic factors such as feed production, efficiency in use of labor and equipment, market outlets, transportation facilities, and price relationships—all of which affect milk production—are constantly changing, and not to the same extent in different areas. Most counties in Illinois have the capacity to increase milk production, but in many cases this would involve some transfer of resources from other enterprises.

The increase in whole milk marketings during World War II was especially marked, but wartime demands merely accelerated a trend that was already well under way before 1940. It seems likely that the upward trend will continue, even though reductions in whole milk marketings may occur in individual years.

Butter should continue to be a major product of the Illinois dairy industry. The percentage of butter produced by plants receiving whole milk will probably increase, and manufacturers who receive long-distance shipments of cream may expect such receipts to decline as whole milk outlets are further developed in Illinois and in neighboring states. One would not expect the cheese industry to maintain the rate of growth experienced in recent years, but the improvements in plant facilities suggests that those in the industry do not expect its position to decline sharply in the near future.

The demonstrated ability of existing evaporated milk plants to expand their output indicates that those plants can supply expected normal demands in the near future. If the manufacture and sale of this product becomes more profitable than other dairy products, opportunities exist for new plants in some areas of Illinois where the increase in average size herds and in whole milk marketings has been large. The

development of the ice cream industry has been closely related to changes in the population and in the level of consumer income. The output of minor dairy products can be expanded by the increased number of diversified plants, if greater use of such products takes place.

Less plant turnover can be expected among diversified plants; many of them have developed sources of milk supply, and they are in a position to shift their production to the most profitable products. Specialized one-product plants will have their least turnover in areas where they have access to plentiful supplies of milk and cream, in periods when the particular product they are making has favorable prices, and among plants where economies result from large scale operation and from specialized production.

Continuous changes in the relative prices of milk and other farm products may be expected in Illinois along with active competition between different enterprises for the use of the farmers' resources. The extent of variation in prices paid by different milk plants will depend largely upon how the milk or cream is utilized and the distance from the major fluid milksheds. The development of more diversified plants should tend to reduce the variation among plants in prices paid for milk.

The dairy industry in Illinois has been shown to be a dynamic one in which changes are constantly occurring. Reasons for the high rate of plant turnover and discontinuance in certain areas merit special study by persons contemplating the establishment of plants in those areas. Likewise, the shift in relative position of different plants producing major products suggests that individual plants must plan for and anticipate future developments if they expect to maintain their position in the state's dairy industry.

# VITA

Ralph Joseph Mutti was born at Hopkins, Missouri, on August 22, 1917. He attended the Hopkins Public School and was graduated from high school in 1934. He received the degree of Bachelor of Science in Agriculture from the University of Missouri in 1938, and the degree of Master of Science in Agricultural Economics from the University of Illinois in 1940.

He was appointed to the staff of the Department of Agricultural Economics, University of Illinois, as an assistant in September, 1938, and did research and extension work in farm management and land economics until September, 1941.

He received a commission as second lieutenant in the Officers' Reserve Corps of the United States Army on October 15, 1938, and was on active duty in the summer of 1939 and the fall of 1941; he received an honorable discharge May 29, 1942.

In January, 1942, he returned to the staff of the University of Illinois and has been engaged in research, teaching, and extension work in agricultural marketing since that time.

Published writings include the following articles in *Illinois Farm Economics*: "Continued Upward Trend in Illinois Land Values," 42 (1938), with C. L. Stewart; "Conserving Trucks and Tires and Reducing Hauling Costs of Country Milk Routes," 83 (1942), with R. W. Bartlett; "Utilization of Milk Produced by Illinois Farmers," 102 (1943); "Assembling Milk from Farm to Market During Wartime," 103 (1943); "Summary of a Survey of Milk Prices in Illinois," 107 (1944); "Seasonal Price Variations in Dairy Production Payments," 109 (1944); "Relation of Cream Sales to Number of Cows Milked in Illinois," 113 (1944); and "Dairy Product Manufacture in Illinois," 120-121 (1945). In addition he has been a contributing author to several mimeographed reports published by the Department of Agricultural Economics, University of Illinois, and to *Illinois Resources*, an atlas published by the Illinois Post-War Planning Commission.

He is a member of Alpha Zeta, Gamma Sigma Delta, Alpha Gamma Sigma, and the American Farm Economic Association.